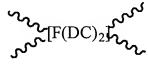
AMENDMENT TO THE CLAIMS

The Listing of Claims replaces all prior versions of claims in the application.

Listing of Claims

1. (Currently amended) A thermosensitive and biodegradable microgel wherein

a) the microgel has a chemically cross-linked network comprising at least one negative temperature-sensitive macromolecule and one biodegradable group represented by structural formula:



wherein

represents chemical cross-linked bonds;

$F(DC)_2$ represents a polymeric chain between the cross-linked bonds; F is a temperature-sensitive block copolymer of poly(ethylene oxide) (PEO) and poly(propylene oxide) (PPO); D is a biodegradable moiety; and C is a cross-linked moiety resulting from C*, a cross-linkable moiety; and

b) the microgel is in the form of microparticles prepared by inverse suspension polymerization comprising the steps:

i) co-polymerizing a biocompatible polymer or oligomer F with an internal ester D by ring opening polymerization of D in the presence of F using a catalyst; wherein F is a temperature-sensitive polymer or oligomer; D is a biodegradable moiety;

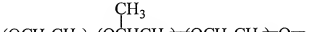
ii) end capping the copolymer with a crosslinkable moiety C* to provide a macromer with crosslinkable ends;

iii) cross linking the crosslinkable end(s) of the macromer to form the microparticles of the microgel.

c. the microgel is useful for encapsulating a drug post polymerization; and

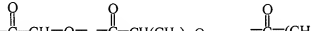
d. the drug encapsulated microgel is injectable into the body.

2. (Original) The thermosensitive and biodegradable microgel of claim 1, wherein the temperature-sensitive polymer or oligomer F is a tri-block copolymer of poly(ethylene oxide) (PEO) and poly(propylene oxide) (PPO), having the formula



wherein X is from 1 to 300, Y from 1 to 300.

3. (Original) The thermosensitive and biodegradable microgel of claim 1, wherein D is a biodegradable oligoester or polyester, or is a biodegradable random or block co-oligoester or co-polyester selected from the group consisting of $(R_1)_m$, $(R_2)_n$, and $(R_3)_l$, wherein R_1, R_2, and R_3 respectively are represented by:



wherein m = 0~100, n = 0~100, l = 0~100, and not all of m, n and l can be zero.

4. (Original) The thermosensitive and biodegradable microgel of claim 1, wherein the cross-linked moiety C is  , wherein R can be -H , -CH_3 or alkyl.

5. (Original) The thermosensitive and biodegradable microgel of claim 1, wherein the temperature-sensitive polymer or oligomer F is used as the principal constituent in an amount based on the microgel in the range of 51 wt %~99.9 wt%.

6. (Original) The thermosensitive and biodegradable microgel of claim 1, wherein the chemically cross-linked network is obtained by crosslinking a

mixture of different block copolymers, F and D and comprising a crosslinked moiety C.

7. (Original) The thermosensitive and biodegradable microgel of claim 1, wherein 0 wt%~49 wt% of the chemically cross-linked network comprises a dangling unpolymerized end.

8. (Original) The thermosensitive and biodegradable microgel of claim 1, wherein the size of the microgel particles is in the range of 5 nm to 5 mm.

9. (Original) The thermosensitive and biodegradable microgel of claim 1, wherein the microgel is in a bulk state or admixed with a solvent.

10. (Currently amended) A method of preparing the thermosensitive and biodegradable microgel by inverse suspension polymerization wherein the continuous phase is a water immiscible solvent selected from the group consisting of heptane, octane, cyclohexane, toluene, dimethylbenzene and a mixture thereof, the method comprising the steps:

a) co-polymerizing a biocompatible polymer or oligomer F with an internal ester D by ring opening polymerization of D in the presence of F using a catalyst; wherein F is a temperature-sensitive polymer or oligomer; D is a biodegradable moiety;

b) end capping the copolymer with a crosslinkable moiety C* to provide a macromer with crosslinkable ends;

c) cross linking the crosslinkable end(s) of the macromer by inverse suspension polymerization in the presence of an initiating agent to form a microgel.

11. (Original) The method of claim 10, wherein C* is a crosslinkable moiety with a double bond and the macromer comprises cross-linkable macro-monomers with two ends selected from the group consisting of macro-monomers with two C*s at the two ends of each macro-monomer and a combination thereof with macro-monomers with one C* at one end of each macro-monomer wherein 0-49 wt % of the total macro-monomers have one C*.

12. (Original) The method of claim 10, wherein the macromer is a mixture of different macromers of the general formula $F(DC^*)_2$ wherein $F(DC^*)_2$ represents a polymeric chain, F is a temperature-sensitive polymer or oligomer; D is a biodegradable moiety; and C* is a cross-linkable moiety.

13. (Original) The method of claim 10, wherein F is the central part of the macromer and is a block copolymer of PEO and PPO with hydroxy ends.

14. (Original) The method of claim 10, wherein the biodegradable moiety D is an internal ester and is selected from the group consisting of oligo-d,l-lactide, poly(d,l-lactide), oligo-l-lactide, poly(l-lactide), oligo-glycollide, polyglycollide, oligo-ε-caprolactone, poly(ε-caprolactone), oligo-(ε-caprolactone substituted by alkyl group), poly(ε-caprolactone substituted by alkyl group), or a copolymer of any of oligo-d,l-lactide, poly(d,l-lactide), oligo-l-lactide, poly(l-lactide), oligo-glycollide, polyglycollide, oligo-ε-caprolactone, poly(ε-caprolactone), oligo-(ε-caprolactone substituted with alkyl, and poly(ε-caprolactone substituted with alkyl.

15. (Original) The method of claim 10, wherein the cross-linkable moiety C* is selected from the group consisting of acryloyl chloride or methyl acryloyl chloride or a derivative of acryloyl chloride.

16. (Original) The method of claim 10, wherein the feed molar ratio of F and the internal ester D ranges from 0.1/99.9 to 99.9/0.1.

17. (Original) The method of claim 10, wherein the catalyst is stannous octoate in amount of above 0.01% molar based on the hydroxyl end groups of F at a reaction temperature between 80 to 280 °C, and a reaction time of from 3 to 50 hours.

18. (Original) The method of claim 10, wherein the catalyst is selected from the group consisting of calcium hydroxide and zinc, at a feed molar ratio based on the hydroxyl end groups of F in the range of from 0.2/0.8 to 0.8/0.2 at a reaction temperature in the range of 50 to 250 °C and a reaction time in the range of 3 to 50 hours.

19. (Original) The method of claim 10, wherein the feed molar ratio of the crosslinkable moiety C*, wherein C* is a moiety with a double bond, and is in the range of 1/1 to 100/1 based on the hydroxyl end groups of F. .

20. (Original) The method of claim 10, wherein the macromer is 1 wt%-49wt% of the solution during the inverse suspension polymerization process.

21. (Original) The method of claim 10, wherein the concentration of the macromer is 3 wt %~98 wt% of the solution and the solvent is water, an aqueous solution, a hydrophilic solvent or a hydrophilic solution.

22. (Original) The method of claim 10, wherein the initiating agent is a redox agent.

23. (Original) The method of claim 22, wherein the amount of the initiating agent is 0.01-8wt% of macromer.

24. (Original) The method of claim 22, wherein the initiating agent is added to the macromer solution.

25. (Original) The method of claim 24, wherein the initiating agent is added at the polymerization temperature.

26. (Original) The method of claim 24, wherein the initiating agent is added at a low temperature below the phase transition temperature, namely, the physical gellation temperature of the macromer solution or the resultant microgel and then the temperature is raised to initiate polymerization after the dispersed drops have been well formed.

27. (Original) The method of claim 26, wherein the polymerization temperature is selected to be higher than the phase transition temperature of the macromer solution or the resultant microgel or to be lower than phase transition temperature but higher than the initial dispersing temperature.

28. (Original) The method of claim 22, wherein none or a part of the initiating agent is added with the bulk macromers or the macromer solution, with the remaining initiating agent added to the continuous phase after the dispersed drops have been well formed.

29. (Original) The method of claim 10, wherein the initiating agent is a thermal energy initiator.

30. (Original) The method of claim 29, wherein the amount of the initiating agent is 0.01-8 wt% of the macromer.

31. (Original) The method of claim 29, wherein the initiating agent is added at a low temperature below the phase transition temperature of the macromer solution or the resultant microgel and then the temperature is raised to initiate polymerization after the dispersed drops have been well formed.

32. (Original) The method of claim 10, wherein the continuous phase in the inverse suspension polymerization is a water-insoluble organic solvent selected from the group consisting of heptane, octane, toluene, dimethylbenzene and a mixture thereof, and the dispersion phase is a hydrophilic medium selected from the group consisting of water or an aqueous solution.

33. (Original) The method of claim 10, wherein an W/O nonionic emulsifier is used in the inverse suspension polymerization process and is selected from the group consisting of Span, Tween and a mixture thereof in a weight ratio of 100~50/0~50 and the emulsifier is add to the solution in an amount that is 1wt %-40wt% of the total solution.

34. (Original) The method of claim 10, wherein the inverse suspension polymerization process is carried on at a reaction temperature in the range of 20 to 100 °C, a reaction time in the range of 0.5 to 8 hours, and a stirring speed in the range of 60 rpm to 2000 rpm.

35. (Original) A method of loading a substance into the network of the thermosensitive and biodegradable microgel of claim 1 by absorbing the substance into the network of the microgel by allowing the microgel to swell in a solution containing the substance at a low temperature below the phase transition temperature of the microgel.

36. (Original) The method of claim 35, wherein the substance absorbed in the gel was entrapped by increasing the temperature, or by drying the hydrogel, or by increasing the temperature and then drying the hydrogel.

37. (Original) The method of claim 35, wherein the absorbed or entrapped substance from the microgels was released into a solution at a temperature above the phase transition temperature of the microgel.

38. (Original) The method of claim 35, wherein the phase transition temperature is below the temperature of a human or a warm-blood animal.

39. (Original) The method of claim 35, wherein the swollen microgel is loaded with a substance and entrapped therein at a temperature above the phase transition temperature of the microgel for a time sufficient to cause further gelation of the network to prevent leakage of the entrapped substance.

40. (Original) The method of claim 35, wherein the loaded substance is a pure substance of a mixture which does not chemically react with the microgel.

41. (Original) The method of claim 35, wherein the loaded substance is biologically active.

42. (Original) The method of claim 41, wherein the solvent for the biologically active substance is water, an aqueous solution or PBS.

43. (Original) The method of claim 41, wherein the biologically active substance is a biomacromolecule or a derivative thereof.

44. (Original) The method of claim 43, wherein the biologically active substance is a protein.